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ELECTRONIC STILL CAMERA
[Denshi suchiru kamera]

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Specification /579*

1. Name of this Invention

Electronic Still Camera

2. Claim(s)

[1] Electronic still camera which processes an image pickup signal outputted from an image pickup element and records the signal to a recording medium, wherein a reflecting mirror formed into the image pickup optical path for reflecting an image pickup optical path at a right angle with respect to an incident optical axis.

3. Detailed Explanation of this Invention

[Technological Field]

This invention pertains to, what we call, an electronic still camera which records an image pickup signal, such as CCD, etc., to a recording medium, such as magnetic disk, IC card, etc., and is particularly associated with the electronic still camera, which can be made thinner by improving the image pickup optical system.

[Description of the Prior Art]

An example of image pickup optical system of a conventional electronic still camera is shown in Fig. 5.

In the figure, item 31 denotes an image pickup lens; 32 denotes an image pickup element such as CCD; and 33 denotes a light absorption surface of said element 32.

The regular image pickup element has a function of scanning in the direction of the arrow (a), where an electronic still camera

equipped with said image pickup element converts the electric charge accumulated in said element 32 into time-sequential signals by scanning and transferring the charge from the lower area to the upper area of said element 32 in the direction of (a) shown in Fig. 5, and then records the signals to a recording medium.

[Problems to be Solved by this Invention]

When we shift our focus on the needs associated with the shape of electronic still camera, maximum miniaturization, particularly thinner devices, is strongly demanded.

However, with the use of the conventional optical system, the total length of optical pickup system becomes the inhibition factor for thinning a camera. Especially, when the recording medium is an IC card, it is impossible to integrate thinning of the principal section of the camera. /580

This invention solves the abovementioned problem. That is, the object of this invention is to provide an electronic still camera, which can be made into a thin device by improving the optical pickup system.

[Method to Solve the Problem]

To achieve the abovementioned purpose, this invention provides an electronic still camera which processes an image pickup signal outputted from an image pickup element and records the signal to a recording medium, wherein the camera is equipped with a reflecting mirror formed into the image pickup optical path for reflecting the

image pickup optical path at a right angle with respect to an incident optical axis.

[Operation]

With this invention, since the electronic still camera has a reflecting mirror formed into the image pickup optical path for reflecting an image pickup optical path at a right angle with respect to an incident optical axis, by making an image pickup element horizontally scan in a direction of the arrow (b) shown in Fig. 5, which is the direction opposite to the normal case, a reproduced picture of upright normal image is obtained. Moreover, an extremely thin profile electronic still camera is easily realized.

[Embodiment of this Invention]

Fig. 1 is a diagram of the first embodiment of this invention.

In Fig. 1, item 1 denotes a camera appearance; 2 denotes a protection glass for the incidence window of image pickup optical path; 3 denotes a reflecting mirror; 4 denotes an aperture unit; 5 denotes an image pickup lens; 6 denotes a complex filter consisting of an optical low-pass filter and infrared ray cut filter; 7 denotes an image pickup element such as CCD; 8 denotes a disk drive mechanism; and 9 denotes a circuit substrate for image pickup signal processing and camera controlling.

Next, Fig. 2 illustrates the image-forming transition in a camera configured as shown in Fig. 1, converting an observed subject into an image.

Part (A) of Fig. 2 is a diagram illustrating the condition when a subject is observed from the point (1) towards (A) in Fig. 1. Item (B) denotes the upward direction.

Part (B) of Fig. 2 is a diagram illustrating the condition when an image formed on the image pickup element 6 is observed from the point (2) towards (A) in Fig. 1. Item (B) denotes the upward direction. Moreover, in Part (B) of Fig. 2, the image pickup element 6 scans from the point (S) in the direction of arrow (b).

Part (C) of Fig. 2 is a diagram illustrating the condition when the image scanned and recorded as described above is scanned from the point (S) in the direction of arrow (c) and reproduced.

Fig. 3 is a diagram illustrating the second embodiment of this invention.

In Fig. 3, item 11 denotes a reflecting mirror; 12 denotes an aperture unit; 13 denotes an image pickup lens; 14 denotes a complex filter consisting of an optical low-pass filter and infrared ray cut filter; 15 denotes an image pickup element; 16 denotes a finder objective lens; 17 denotes a finder eyepiece; 18 denotes an automatic focus projection lens; 19 denotes a light emitting diode; 20 denotes an automatic focus light absorbent lens; 21 denotes a light absorbent element; 22 denotes a disk drive mechanism; and 23 denotes a circuit substrate.

Next, Fig. 4 illustrates the image-forming transition in a camera configured as shown in Fig. 3, converting an observed subject into an image.

Part (A) of Fig. 4 is a diagram when a subject is observed from the point (1) towards (A) in Fig. 3. Item (B) denotes the upward direction.

Part (B) of Fig. 4 is a diagram when an image formed on an image pickup element 15 is observed from the point (2) towards (A) in Fig. 3. Item (B) denotes the upward direction. The image pickup element 15 is for scanning from the point (S) shown in Part (B) of Fig. 4 in the direction of the arrow (b) in the figure.

Part (C) of Fig. 4 is a diagram illustrating the condition when an image scanned and recorded as described above is scanned in the direction of arrow (c) from the point (S) and reproduced.

The abovementioned first embodiment is configured to reflect the optical path downwardly using the reflecting mirror 3, whereas the abovementioned second embodiment is configured to reflect the optical path horizontally using the reflecting mirror 11. In both cases, by applying an image pickup element scanning horizontally in the direction of (b) shown in Fig. 5, which is opposite to the normal direction, the image can be reproduced as an upright normal image.

Moreover, if a lens of long focus point is required as an image pickup lens, a part of the image pickup lens is effectively arranged towards the subject side from the reflecting mirror 3 in Fig. 1 and

reflecting mirror 11 in Fig. 3. This configuration can be considered as an embodiment of this invention. In addition, the configuration in which a close-up lens, tele-converter, wide converter, etc. is inserted removably at the subject side of the reflecting mirror /581 can be considered as an embodiment of this invention. Furthermore, although item 8 in Fig. 1 and item 22 in Fig. 3 are configured as disk drive mechanisms, when the recording medium is an IC card, such parts are replaced with appropriate mechanisms.

[Effectiveness of this Invention]

As explained above, since the camera based on this invention has a reflecting mirror formed into the image pickup optical path for reflecting the image pickup optical path at a right angle with respect to an incident optical axis, by allowing the image pickup element to scan horizontally in the direction opposite to a normal case, an upright normal image is obtained as the reproduced image. Furthermore, an extremely thin-profile electronic still camera can be easily realized.

4. Simple Explanation of the Figures

Fig. 1 is a cross-sectional diagram illustrating the first embodiment of this invention. Parts (A) - (C) of Fig. 2 illustrate the operational transition in an optical system of an electronic still camera configured as shown in Fig. 1 when a picture of a subject is taken by the camera and made into an image. Fig. 3 is a perspective view of the second embodiment of this invention. Parts

(A) - (C) of Fig. 4 illustrate the operational transition in an optical system of an electronic still camera configured as shown in Fig. 3 when a picture of a subject is taken by the camera and made into an image. Fig. 5 is a perspective view of an example of conventional technology.

1...Camera appearance; 3...Reflecting mirror; 5...Image pickup lens; 7...Image pickup element; 11...Reflecting mirror; 13...Image pickup lens; 15...Image pickup element

Figure 1

Figure 4

Figure 2 /582

Figure 3